Tannin determination in young coconut coir (Cocos nucifera L.) by FTIR and UV-Vis spectroscopy

by Jurnal Pendidikan Kimia

Submission date: 20-May-2025 01:32AM (UTC+0700)
Submission ID: 2679993726
File name: 6.pdf (304.87K)
Word count: 3023
Character count: 16883

Jurnal Matematika Dan Ilmu Pengetahuan Alam LLDikti Wilayah 1 (JUMPA), 3 (1) (2023) 08-13

Published by: LLDIKTI WILAYAH 1

Jurnal Matematika Dan Ilmu Pengetahuan Alam LLDikti Wilayah 1 (JUMPA)

Journal homepage: www.lldikti1.ristekdikti.go.id/jurnal/index.php/jumpa

Tannin determination in young coconut coir (Cocos nucifera L.) by FTIR and UV-Vis spectroscopy

Yelfira Sari, Putri Ade Rahma Yulis

Department of Chemistry Education, Universitas Islam Riau, Pekanbaru, Indonesia

Article Info

Article history:

Received: Feb 6, 2023
Revised: Feb 13, 2023
Accepted: Mar 25, 2023

Keywords:

Coconut husk;
Condensed tannin;
Polyphenolic ;
Secondary metabolites;
Spectroscopy.

ABSTRACT

The coir of young coconut is the largest by product of coconut. Young coconut coir has no important industrial uses and until now has been incinerated or dumped without control. This is because utilization of young coconut coir is not easy as the old one. Tannin has pharmacological activities including anti-inflammatory, antioxidant, anti-tumor This study aims to determine tannin in young coconut coir (*Cocos nucifera* L.) using a complementary analytical technique, Fourier Transform Infrared (FTIR) and Ultraviolet-Visible (UV-Vis) spectroscopy. Sample of young coconut coir was obtained from the waste of bargainer at the local market. Sample was maserated using ethanol as the solvent and then was evaporated to get concentrated extract. The FTIR and UV-Vis spectra showed that the sample was indicated to contain tannin. The presence of tannin was indicated by appearance of peak at 283 nm and 326 nm in UV-Vis spectra and in the region between 1610-1445 cm^{-1} by FTIR. This research is an early stage in the characterization of tannin compounds from young coconut coir extract. It is expected that waste have economic value in the future.

Corresponding Author:

Yelfira Sari,
Department of Chemistry Education,
Universitas Islam Riau,
Jl. Kaharuddin Nst No.113, Kota Pekanbaru, Riau 28284, Indonesia.
Email: yelfirasari@edu.uir.ac.id

INTRODUCTION

Tannin is polyphenolic secondary metabolites that are found in several parts of plants, bark, wood, leave, root, seed, and fruit (Morbeck et al., 2019), (Falcão & Araújo, 2018), (Das et al., 2020). There are two major classes of vegetable tannin (tannin that are produced in nature), hydrolyzable tannin, and condensed tannin (also named proanthocyanidin). Hydrolyzable tannins consist of a glucose core esterified to aromatic acids with occasional or multiple complex esters, which contain two subclasses, gallotannins and ellagitannins. Condensed tannins are composed of flavan-3-ol monomers (Das et al., 2020), (Ju et al., 2021). Condensed tannins are one of the most abundant group of natural polymers after lignins that widely distributed in plant kingdom and often referred to proanthocyanidin due to their ability to release anthocyanidins upon depolymerization under strongly acidic conditions (Gourlay & Constabel, 2019), (Panzella & Napolitano, 2022).

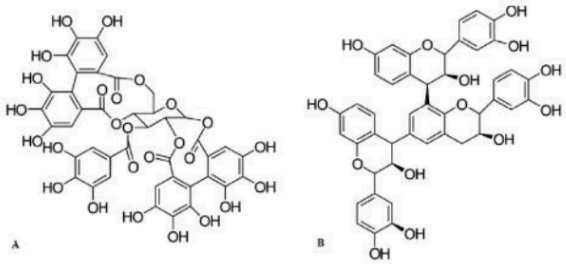

Figure 1. Classification of tannin (A) hydrolyzable tannin; (B) condensed tannins (Das et al., 2020)

Glucogallins (a kind of hydrolyzed tanins) are an esterification of gallic acid and glucose. Glucogallins have some biological activities that come from the hydrolysate. The pharmacological activities of glucogallins including anti-inflammatory, antioxidant, anti-tumor. It also provide treatment for hypertension, myocardial infarction, and diabetes in traditional (Xiong et al., 2021).

Young coconut water is the right choice to quench the thirst. It is so refreshing, slightly sweet, and keeps us hydrated in hot climate. It is also rich in electrolytes and micronutrients that are exceptionally beneficial to our health. Fresh coconut water can be found at the road side stand alongside the city. Unfortunately, consumption of young coconut water generates large volume of solid waste, especially the husk fiber/coir (Guedes et al., 2018). That waste are more difficult to process than the old one. Generally, the traders let the waste piled up. This caused a negative effect on the health and also environment.

In previous studies, an analysis of the secondary metabolite content of young coconut coir was carried out. Young coconut coir was maserated using three solvents with different polarity, hexane, acetone, and ethanol. The result showed that ethanol is the suitable solvent which the ethanolic extract of young coconut coir contains flavonoids, terpenoids, and tannins (Sari et al., 2021). This study aims to determine secondary metabolytes of tannin from young coconut coir. This informations are essential to generate alternatives that give value to the young coconut coir. This work was analyzed by complementary analytical techniques, Fourier Transform Infra Red (FTIR) and Ultraviolet-Visible (UV-Vis) spectroscopy.

RESEARCH METHOD

Equipment and materials

UV-Vis spectra was acquired on Shimadzu UV-1900i double-beem spectrophotometer, FTIR analysis was carried out by the IRSpirit Fourier Transform Infrared spectrophotometer, rotary evaporator (IKA Rotary Evaporator RV 10 Digital), analytical balance, dark bottle (for extraction), beaker glass (pyrex), and wooden spoon as stirring rod (Okafor et al., 2021)(Picollo et al., 2018) (Makuła et al., 2018). Sample was young coconut coir *(Cocos nucifera* Linn Var. Viridis*),* more known as Kelapa Hijau, that obtained from the waste of bargainer at the local market around Marpoyan Damai subdistrict, Pekanbaru-Riau. The solvent used was ethanol of analytical grade (96%) and aquadest. Ethanol has been selected as general solvent, as ethanol is a safe option for plant extraction due to the fact that it leaves behind a safe to use, non-toxic oil product.

Preparation

The coconut was split into two to made it easier removing the coir from the coconut. The coir was dried under the sun and then extracted with maceration method by using ethanol as the solvent. Sample was weighed 500 gram and macerated using 1 L ethanol in dark bottle for 24 h in room

temperature. The extract was filtered and evaporated with rotary evaporator (phytochemical tested have been done on previous study) (Weli et al., 2018) (Ahmed et al., 2022). All extract were placed in a room temperature condition before used for further works.

UV-Vis spectrophotometry

Tannins spectra were acquired using 10 µL aliquot of a aqueous tannin solution (10 mg/mL) diluted in 5 mL of distilled water. The extracts were scanned in the wavelength ranging from 200-400 nm using Shimadzu UV-1900i double-beem spectrophotometer and the characteristic peaks were detected. The peak values of the UV were recorded and compared with the literature (Passos & Saraiva, 2019)(Tajodini et al., 2020)(Sholikhah et al., 2020).

FTIR spectroscopy

Preparation sample was made from ± 2mg sample and 200 mg KBr, mixed quickly homogeneously using mortar (Dutta, 2017)(Dutta, 2017). Furthermore, sample measured using IRSpirit Fourier Transform Infrared spectrophotometer within the wave number range between 4000 and 400 cm^{-1} in ± 60 second. The peak values of the FTIR were recorded and compared with the literature (Mohamed et al., 2017).

RESULTS AND DISCUSSIONS

UV-Vis spectrophotometry

UV-Vis spectrophotometry is the most popular techniques in the characterization of chemical compounds in both analytical and organic fields. This is widely used because it has the ability to analyze many chemical compounds and the ease of sample preparation when compared to other analytical methods. In the field of organic chemistry, it can be used in the determination and quantification of polyphenolic compounds from natural extracts (Fouladvandi & Elhami, 2017).

Tannins are polyphenolic compounds that can be easily extracted with water. Tannins can be found in the roots, stems, leaves, and fruit of a plant that has a molecular weight between 500-30,000 g/mol (Cano et al., 2021),(Sirisangsawang & Phetyim, 2023). Vegetable tannin extracts (tannic compounds obtained from plants) even with a molecular weight of up to 3,000 g/mol provide absorption at lower wavelengths compared to other smaller molecules. This is because the main chromophore group of this compound is an aromatic ring, where this aromatic ring does not have a large electronic displacement, resulting the absorption occurs in ultraviolet region (Grasel et al., 2016). Extracts of tannin compounds provide maximum absorption at wavelengths between 204-284 nm (Grasel et al., 2016), (Falcão & Araújo, 2018).

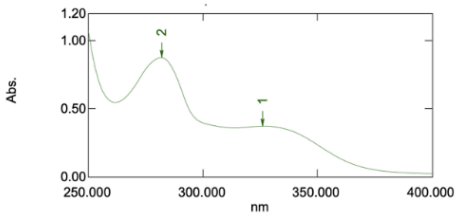

Figure 2. Ultraviolet spectrum of tannin from young coconut coir. (1) 326 nm; (2) 282 nm.

Figure **2** shows the spectrum of young coconut coir extract. The analysed sample was in the visible region. It presented two absorption maximum in 282 nm (λ_1) and 326 nm (λ_2). Based on the literature, this wavelength is a specific absorption of tannin compounds. Previous studies showed the characteristic of UV absorption of different classes of tannin. Hydrolysabel tannins showed two characteristic wavelength, λ_{max1} around 212 nm and λ_{max2} around 275 nm, with distinctive inflection point around 242 nm for gallotannins and strong absorption near 200 nm and a shoulder around 277

nm for ellagitannins. Condensed tannins showed a strong absorption around 200 nm, an inflection point (λ_{min}) between 258–259 nm and λ_{max} between 279–281 nm (Falcão & Araújo, 2018)

FTIR spectroscopy

FTIR spectroscopy is a useful tool for determination and characterization of compounds, especially organic compounds, both qualitatively and quantitatively. It is widely used due to its relative low cost and ease of preparation (Ricci et al., 2015). Analysis was carried out by looking at the specific peaks that indicate the type of functional group of the compound. The molecule of chemical compound can be identified by comparing its peak to a data bank of IR spectra. Practically, FTIR spectroscopy is a great method to determine functional groups.

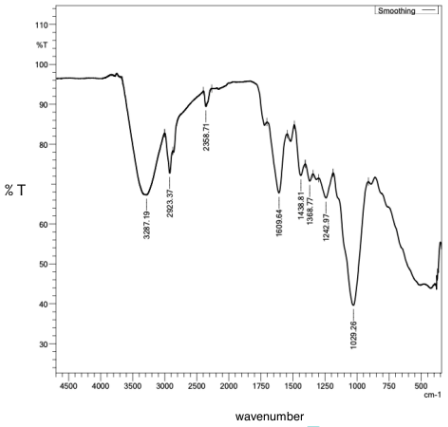

Figure 3. FTIR spectrum of tannin from young coconut coir

Table 1. Assignment of FTIR spectrum of tannin from young coconut coir

Sample (cm^{-1})	Literature (cm^{-1})*	Group	Characteristics
3287.19	3356; 3318	O-H	Stretching vibration and due to the wide variety of hydrogen bonding between OH
2923.97	2725; 2973,2931	(-CH_3, -CH_2-)	Symmetric and antysimetric -C-H- stretching vibration
2358.71	-	-	-
-	1718; 1878	C=O	Stretching vibration (characteristic bands of carbonyl groups)
1609.64	1614; 1619,1534, 1501	C-O	Aromatic squeal vibration (Arom-C-O-)
1438.81	1452; 1439	CH_2	Aromatic ring vibration (Arom-CH_2-OH)
1368.77	1328	O-H	
1242.97	1191; 1308, 1264, 1212	C-O-C	Stretching vibration
1029.26	-; 1066	C-O	Stretching vibration

*(Marques et al., 2021)

FTIR spectrum of young coconut coir extracts in the wavenumber range of 4000 to 400 cm^{-1} is shown in Fig. 3. The peak width in the 3287.19 cm^{-1} region results from molecules having hydrogen (-OH). The peak near the wavenumber 2923.97 cm^{-1} is produced by the C-H stretching vibrations of -CH and -CH_2 belonging to the aliphatic group. The peak between 1609.64 cm^{-1} and 1438.81cm^{-1} indicates the presence

of an aromatic ring in the sample extract. The high intensity around 1609.61 cm^{-1} indicates a high amount of C4-C8 interflavonoid. The peak observed between 1242.97 cm^{-1} to 1029.26 cm^{-1} is characteristic of C–O–C including aromatic C–O and aliphatic C–O the secondary (Zhang et al., 2017), (Marques et al., 2021).

This research is in accordance with previous study by Falcao and Araujo (2018). Tannins present four strong characteristic bands, two of them at 1525–1606 cm^{-1} and 1452–1446 cm^{-1} assigned to aromatic ring stretch vibrations and the other two at 1211–1196 cm^{-1} and 1043–1030 cm^{-1} assigned to stretch vibrations of C–O bond. However, to obtain more accurate result, more sensitive equipment can be used such as GC-MS.

CONCLUSION

The results of UV-Vis spectrophotometry showed maximum absorption at wavelengths of 282 nm and 326 nm. This corresponds to the maximum absorption of tannin compounds. From the results of UV-Vis spectrophotometry and FTIR, the ethanol extract of young coconut coir indicated the presence of tannin. Advanced research, using advanced analytic instrumentations, is needed for the characterization of tannins from young coconut coir extract. Biological activity test is also needed to determine the potential of young coconut coir extract for the global health.

ACKNOWLEDGEMENTS

The authors are grateful to Lembaga Penelitian dan Pengabdian kepada Masyarakat (LPPM) Universitas Islam Riau for the financial assistance provided in this research process and for the support in the implementation of this research.

REFERENCES

Ahmed, N., Karobari, M. I., Yousaf, A., Mohamed, R. N., Arshad, S., Basheer, S. N., Peeran, S. W., Noorani, T. Y., Assiry, A. A., & Alharbi, A. S. (2022). The antimicrobial efficacy against selective oral microbes, antioxidant activity and preliminary phytochemical screening of Zingiber officinale. *Infection and Drug Resistance*, 2773–2785.

Cano, A., Contreras, C., Chiralt, A., & González-Martínez, C. (2021). Using tannins as active compounds to develop antioxidant and antimicrobial chitosan and cellulose based films. *Carbohydrate Polymer Technologies and Applications*, *2*. https://doi.org/10.1016/j.carpta.2021.100156

Das, A. K., Islam, M. N., Faruk, M. O., Ashaduzzaman, M., & Dungani, R. (2020). Review on tannins: Extraction processes, applications and possibilities. In *South African Journal of Botany* (Vol. 135, pp. 58–70). Elsevier B.V. https://doi.org/10.1016/j.sajb.2020.08.008

Dutta, A. (2017). Fourier transform infrared spectroscopy. *Spectroscopic Methods for Nanomaterials Characterization*, 73–93.

Falcão, L., & Araújo, M. E. M. (2018). Vegetable tannins used in the manufacture of historic leathers. *Molecules*, *23*(5), 1–20. https://doi.org/10.3390/molecules23051081

Fouladvandi, B., & Elhami, S. (2017). Ultra-Trace Determination of Silver in Water, Soil and Radiology Film Samples Using Dispersive Liquid-Liquid Microextraction and Microvolume UV–Vis Spectrophotometry. *Iranian Journal of Chemistry and Chemical Engineering (IJCCE)*, *36*(6), 163–170.

Gourlay, G., & Constabel, C. P. (2019). Condensed tannins are inducible antioxidants and protect hybrid poplar against oxidative stress. *Tree Physiology*, *39*(3), 345–355. https://doi.org/10.1093/treephys/tpy143

Grasel, F. dos S., Ferrão, M. F., & Wolf, C. R. (2016). Ultraviolet spectroscopy and chemometrics for the identification of vegetable tannins. *Industrial Crops and Products*, *91*, 279–285. https://doi.org/10.1016/j.indcrop.2016.07.022

Guedes, D. (Douglas), Martins, G. (Gabriel), Alviano, D. S. (Daniela), Lutterbach, M. T. S. (Marcia), Reznik, L. Y., & Sérvulo, E. F. (2018). Coconut Husk Fiber Proanthocyanidins: Ecofriendly Corrosion Inhibitor, Ecotoxicity and Biocide Activity. *International Journal of Engineering and Technical Research*, *8*(2), 27–29.

Ju, Y. lun, Yang, L., Yue, X. feng, He, R., Deng, S. lin, Yang, X., Liu, X., & Fang, Y. lin. (2021). The condensed tannin chemistry and astringency properties of fifteen Vitis davidii Foex grapes and wines. *Food Chemistry: X*, *11*(April), 100125. https://doi.org/10.1016/j.fochx.2021.100125

Makuła, P., Pacia, M., & Macyk, W. (2018). How to correctly determine the band gap energy of modified

semiconductor photocatalysts based on UV–Vis spectra. In *The journal of physical chemistry letters* (Vol. 9, Issue 23, pp. 6814–6817). ACS Publications.

Marques, S. R. R., Azevêdo, T. K. B., de Castilho, A. R. F., Braga, R. M., & Pimenta, A. S. (2021). Extraction, quantification, and ftir characterization of bark tannins of four forest species grown in northeast brazil. *Revista Arvore*, *45*, 1–10. https://doi.org/10.1590/1806-90882021000041

Mohamed, M. A., Jaafar, J., Ismail, A. F., Othman, M. H. D., & Rahman, M. A. (2017). Fourier transform infrared (FTIR) spectroscopy. In *Membrane characterization* (pp. 3–29). Elsevier.

Morbeck, F. L., Lelis, R. C. C., Schueler, M. V. E., Santos, W. A., Sampaio, D. A., Da Silva, B. C., Morais, R. D. M., & Santana, G. M. (2019). Extraction and evaluation of tannin from green coconut mesocarp. *Revista Materia*, *24*(3). https://doi.org/10.1590/s1517-707620190003.0748

Okafor, E. G., Abba, M. T., Ubadike, O. C., Agbo, S., & Muhammad, M. H. (2021). Fourier-Transform Infrared Spectroscopy and Thermal Investigation of Hybrid Banana/Sisal Fiber Reinforced Polyester Matrix Composite. *Advanced Materials Research*, *1165*, 39–46.

Panzella, L., & Napolitano, A. (2022). Condensed Tannins, a Viable Solution to Meet the Need for Sustainable and Effective Multifunctionality in Food Packaging: Structure, Sources, and Properties. *Journal of Agricultural and Food Chemistry*, *70*(3), 751–758. https://doi.org/10.1021/acs.jafc.1c07229

Passos, M. L. C., & Saraiva, M. L. M. F. S. (2019). Detection in UV-visible spectrophotometry: Detectors, detection systems, and detection strategies. *Measurement*, *135*, 896–904.

Picollo, M., Aceto, M., & Vitorino, T. (2018). UV-Vis spectroscopy. *Physical Sciences Reviews*, *4*(4), 20180008.

Ricci, A., Olejar, K. J., Parpinello, G. P., Kilmartin, P. A., & Versari, A. (2015). Application of Fourier transform infrared (FTIR) spectroscopy in the characterization of tannins. *Applied Spectroscopy Reviews*, *50*(5), 407–442. https://doi.org/10.1080/05704928.2014.1000461

Sari, Y., Yulis, P. A. R., Putri, I. I., Putri, A. M., & Anggraini, S. (2021). Penentuan Kandungan Metabolit Sekunder Ekstrak Etanol Sabut Kelapa Muda (Cocos nucifera L .) Secara Kualitatif. *Journal of Research and Education Chemistry (JREC)*, *3*(2), 113–121.

Sholikhah, U. N., Pranowo, D., Arvianto, R. I., Sarmini, E., & Widyaningrum, T. (2020). Purification Method of Silver Nanoparticles (AgNPs) and its Identification Using UV-Vis Spectrophotometer. *Key Engineering Materials*, *840*, 484–491.

Sirisangsawang, R., & Phetyim, N. (2023). Optimization of tannin extraction from coconut coir through response surface methodology. *Heliyon*, *9*(2), e13377. https://doi.org/10.1016/j.heliyon.2023.e13377

Tajodini, N., Moghimi, A., & Karimnezhad, K. (2020). Separation of levodopa using Nanotubes Carbon modified Methyl Amine in biological samples and determination by UV-Vis Spectrophotometry. *Journal of Advanced Pharmacy Education & Research| Oct-Dec*, *10*(S4).

Weli, A. M., Al-Salmi, S., Al Hoqani, H., & Hossain, M. A. (2018). Biological and phytochemical studies of different leaves extracts of Pteropyrum scoparium. *Beni-Suef University Journal of Basic and Applied Sciences*, *7*(4), 481–486.

Xiong, P., Qin, S. han, Li, K. lin, Liu, M. juan, Zhu, L., Peng, J., Shi, S. lin, Tang, S. nv, Tian, A. ping, & Cai, W. (2021). Identification of the tannins in traditional Chinese medicine Paeoniae Radix Alba by UHPLC-Q-Exactive Orbitrap MS. *Arabian Journal of Chemistry*, *14*(11), 103398. https://doi.org/10.1016/j.arabjc.2021.103398

Zhang, A., Li, J., Zhang, S., Mu, Y., Zhang, W., & Li, J. (2017). Characterization and acid-catalysed depolymerization of condensed tannins derived from larch bark. *RSC Advances*, *7*(56), 35135–35146. https://doi.org/10.1039/c7ra03410e

Tannin determination in young coconut coir (Cocos nucifera L.) by FTIR and UV-Vis spectroscopy

ORIGINALITY REPORT

19%	13%	10%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Fathi Guemari, Salah Eddine Laouini, Abdelkrim Rebiai, Abderrhmane Bouafia, Ali Tliba, Ahmed Barhoum. "UV-Visible Spectroscopic Technique for Prediction of Total Polyphenol Contents for a Bunch of Medicinal Plant Extracts", Research Square Platform LLC, 2022 Publication	1%
2	max-success.eu Internet Source	1%
3	recerc.eu Internet Source	1%
4	www.freeradicals2013.de Internet Source	1%
5	etd.repository.ugm.ac.id Internet Source	1%
6	Wan-Qing KONG, Ming-Wei LIU, Shou-Tao WANG, Hui-Hui GAO, Zhao QIN, Hua-Min LIU, Xue-De WANG, Jing-Ren HE. "Enhancing extraction of proanthocyanidins from Chinese quince fruit by ball-milling and enzyme hydrolysis: yield, structure, and bioactivities", Food Science and Technology, 2022 Publication	1%
7	Submitted to Universitas Islam Negeri Raden Fatah Student Paper	1%

8	Zetriuslita Zetriuslita, Rezi Ariawan. "STUDENTS' MATHEMATICAL THINKING SKILL VIEWED FROM CURIOSITY THROUGH PROBLEM-BASED LEARNING MODEL ON INTEGRAL CALCULUS", Infinity Journal, 2020 Publication	1 %
9	Submitted to Birkbeck College Student Paper	1 %
10	Submitted to Higher College of Technology Student Paper	1 %
11	jns.kashanu.ac.ir Internet Source	1 %
12	Thaíse da Silva Borges, Luciano Matos Queiroz, Sérgio Luís Costa Ferreira, Nádia Mamede José. "Obtaining cashew bark extract and its application for removal of metallic species in aqueous matrix", Research Square Platform LLC, 2023 Publication	1 %
13	journal.uad.ac.id Internet Source	1 %
14	Submitted to iGroup Student Paper	1 %
15	journal.ipb.ac.id Internet Source	1 %
16	Jiongjiong Li, Wenjie Zhu, Shifeng Zhang, Qiang Gao, Changlei Xia, Wei Zhang, Jianzhang Li. "Depolymerization and characterization of Acacia mangium tannin for the preparation of mussel-inspired fast-curing tannin-based phenolic resins", Chemical Engineering Journal, 2019 Publication	1 %

17	Fernanda Lago Morbeck, Roberto Carlos Costa Lelis, Maria Vanessa Egger Schueler, Wanessa Aparecida Santos et al. "Extraction and evaluation of tannin from green coconut mesocarp", Matéria (Rio de Janeiro), 2019 Publication	<1 %
18	Myleidi Vera, Claudio Mella, Yadiris García, Verónica A. Jiménez, Bruno F. Urbano. "Recent advances in tannin-containing food biopackaging", Trends in Food Science & Technology, 2023 Publication	<1 %
19	oulurepo.oulu.fi Internet Source	<1 %
20	Wanlong Lu, Tingnan Song, Wenping Lei, Yanting Li, Jingming Li, Jinkun Du. "Impact of adding sorghum tannin on volatile compounds and fermentation products of whisky", Food Bioscience, 2025 Publication	<1 %
21	encyclopedia.pub Internet Source	<1 %
22	pubs.rsc.org Internet Source	<1 %
23	scholar.ufs.ac.za Internet Source	<1 %
24	transport.vgtu.lt Internet Source	<1 %
25	www2.mdpi.com Internet Source	<1 %
26	Ahmed Nasr, Mohammed El Shaer, Mohamed Abd-Elraheem. "Potential Application of Used	<1 %

Coffee Grounds in Leather Tanning", Journal of Ecological Engineering, 2023
Publication

27	Gandhar Pradhan, Yogesh A. Kulkarni. "Chapter 12-1 Role of Hydrolyzable and Condensed Tannins in Cardiovascular Diseases", Springer Science and Business Media LLC, 2023 Publication	<1 %
28	Papadopoulos, A.I.. "Efficient integration of optimal solvent and process design using molecular clustering", Chemical Engineering Science, 200610 Publication	<1 %
29	nita sahara, Reni Fitria, agusti efi, Sukma Yudistira. "UTILIZATION OF YOUNG COCONUT FIBERS AS TEXTILE DYES. In The 2nd International Conference on Culinary, Fashion, Beauty and Tourism (ICCFBT) 2019 (iccfbt.fpp.unp.ac.id)", Open Science Framework, 2020 Publication	<1 %

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		